



## *Poly-Chill*<sup>®</sup> Fluid

*Poly-Chill*<sup>®</sup>\* fluid is a viscous, stable, hygroscopic liquid which is completely miscible with water. It is formulated with USP grade propylene glycol and inhibited with food-grade dipotassium phosphate to prevent corrosion. Propylene glycol is designated as "generally recognized as safe" (GRAS) by the Food and Drug Administration. Specifications and Typical Physical Properties are given in Tables 1 and 2.

**Table 1**  
**Specifications**

Specific Gravity @ 60/60°F	1.048-1.053
Color, max (APHA)	10
Freezing Point, 50% aqueous solution by volume, max (°F)	-32
Reflux Boiling Pt., °F, min	310
Dipotassium Phosphate, Food Grade, wt%	1.8 to 2.25
Odor	mild
Sediment	None
Clarity	Clear

**Table 2**  
**Typical Physical Properties**

Density @ 16°C (lb/gal)	8.74
Fire Point, COC (°C)	104
Flash Point, COC (°C)	102
(°F)	215
Freezing Point, aqueous solution (°C)	
30%	-13
40%	-21
50%	-32

### Applications

*Poly-Chill* fluid is authorized by USDA for use in Federally inspected meat and poultry plants.

Aqueous solutions are widely used in the immersion freezing of plastic-wrapped poultry. The freezing bath temperature is generally maintained at -18°C (0°F) to

freeze the poultry to a depth of 3/8 to 1/2 inch in 30 minutes. Freezing of the poultry is completed in a freezing room as a separate operation.

Food products such as fish, meat and vegetables are normally frozen by exposure to high velocity air that is prechilled by contact with cooling coils. *Poly-Chill* fluid is continuously sprayed over the coils to prevent formation of frost or ice that would otherwise result from condensation of moisture from the air. The resulting diluted glycol can be reconcentrated for reuse.

As solar technology has developed, aqueous solutions of propylene glycol have received wide acceptance as a heat-transfer fluid in areas where freezing is a problem. The aqueous glycol solutions provide freeze protection. In this application, the use of *Poly-Chill* fluid is particularly advantageous in that the inhibitor provides corrosion protection. The inhibitor concentration must be monitored periodically to ensure corrosion protection.

### Preparation of Cooling Systems

Closed cooling systems should be cleaned before adding *Poly-Chill* fluid, particularly if the type of coolant is being changed (i.e., changing from brine). In general, an alkaline cleaner, when used according to the manufacturer's directions, will recondition a cooling system that has not been misused. Thorough rinsing by flushing several times with tap water will ensure complete removal of the chemical cleaner and any remaining sediment.

If any acid-type cleaner is used, the system must be completely neutralized with a weak solution (1-5%) of sodium carbonate (soda ash) before rinsing with water. This type of cleaner is quite reactive and should be used only to dislodge extensive scale and rust deposits.

Prior to adding *Poly-Chill* fluid to a new cooling system, the system should be treated with a 1-2% aqueous solution of sodium orthosilicate and rinsed to remove dirt, scale or other adhering substances.

### Concentration of Coolant

Propylene glycol is diluted by water absorbed during immersion-freezing or coil-defrosting operations. Dilution



may lead to failures and possibly freezing of the system. Therefore, it is important that the freezing point or concentration be checked periodically. Additional propylene glycol should be added as required.

ASTM Method D-1177-65 is suggested to determine the freezing point of an aqueous solution of *Poly-Chill* fluid. Figure 1 gives the approximate freezing curve of aqueous solutions.

A rapid estimation of the concentration of *Poly-Chill* fluid can be obtained from the refractive index. The relationship between concentration and refractive index is shown in Figure 2. To make a quick determination of fluid concentration to an accuracy of 0.5%, American Optical fluid tester Model 10440, which is temperature compensated, can be used. Figure 3 shows the relationship between readings on this instrument and the concentration of *Poly-Chill* fluid. The relationship between measurements on this instrument and freezing points are shown in Figure 4.

### Reinhibition of Solution

Where food processing equipment is made of metal other than stainless or resin-coated steel, depletion of inhibitor may occur during prolonged use. The inhibitor concentration should be maintained at a minimum of 0.5% by weight. It is checked by determining the reserve alkalinity. To add additional inhibitor to the system, dissolve the dipotassium phosphate in a small amount of water and add the solution to the system.

### Reserve Alkalinity

Method:

A 10 mL sample of fluid is dissolved in distilled water and titrated potentiometrically to a pH of 5.5 with 0.1N HCl. The reserve alkalinity is defined as the milliliters of 0.1N HCl required to attain a pH of 5.5. Results can also be defined as weight percent  $K_2HPO_4$ . This method will detect any basic species which is of a similar basicity or stronger than  $HPO_4^{=}$  that might be present.

Equipment:

#### Apparatus

1. Device capable of measuring pH, i.e., a pH meter or an automatic titrator. (Note 1)
2. Electrode for measurement of pH in aqueous media. Either a combination electrode or a pH sensor used in conjunction with a calomel reference electrode is necessary.

3. Magnetic stirrer and stirring bars.
4. 10 mL pipet, graduated in 0.1 mL segments.
5. Analytical balance.
6. General laboratory glassware and equipment.

#### Reagents

1. Buffer solutions, pH 4, 7 and 10 for calibration.
2. Distilled water.
3. HCl, 0.1N, standardized: Pipet 8.3 mL concentrated HCl into a 1L volumetric containing distilled water. Add water to the mark and mix thoroughly. To standardize, weigh 0.1 g analytical grade tris(hydroxymethyl)aminomethane (THAM) to the nearest 0.1 mg into a 150 mL beaker. Dissolve in distilled water and titrate with HCl to the endpoint. (Note 2)

Procedure:

1. Calibrate the pH electrode as per the pH meter or titrator instructions.
2. Pipet 10 mL (Note 3) of fluid into a 150 mL beaker. Add 90 mL of distilled water.
3. Add a stirbar to the beaker and stir the sample at a moderate speed with no splashing.
4. Immerse the electrode(s) into the solution.
5. Titrate the solution with the HCl and follow the pH changes. As the pH approaches 5.5, slow the addition rate to 0.1 to 0.2 mL per aliquot to allow for stabilization of the readings.
6. Record the volume of HCl needed to reach pH 5.5. Adjust this value as needed to report the reserve alkalinity. (Notes 4 - 5)

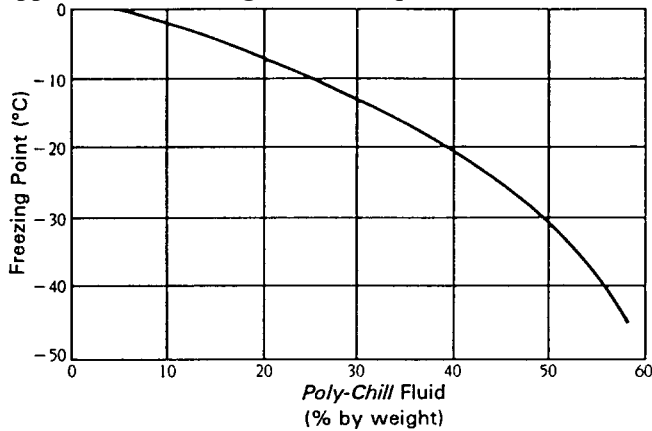
Note 1: If an automatic titrator is used, it should be equipped with a 10 mL burette. If a titrator is preferred, the titration can be taken to the first endpoint. It is then recommended that a weighed (10 g) sample be used and the results calculated as weight percent  $K_2HPO_4$  as in notes 3 - 5 below.

Note 2: The endpoint for the standardization can be determined potentiometrically with an automatic titrator, or the indicator phenolphthalein can be used for visual determination. With phenolphthalein, the color change is from pink to colorless.

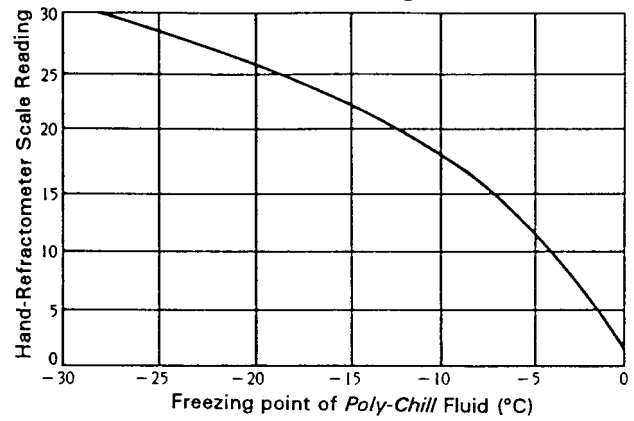
Note 3: If the determination needs to be done on a weight basis, 10 g of sample should be used.



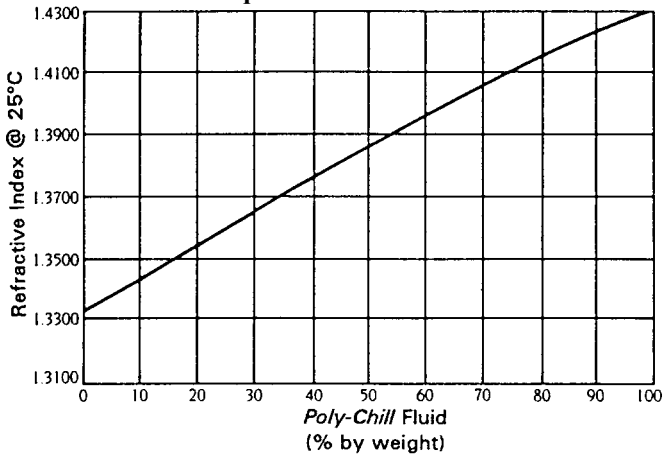
**Figure 1**  
Approximate Freezing Points of Aqueous Solutions



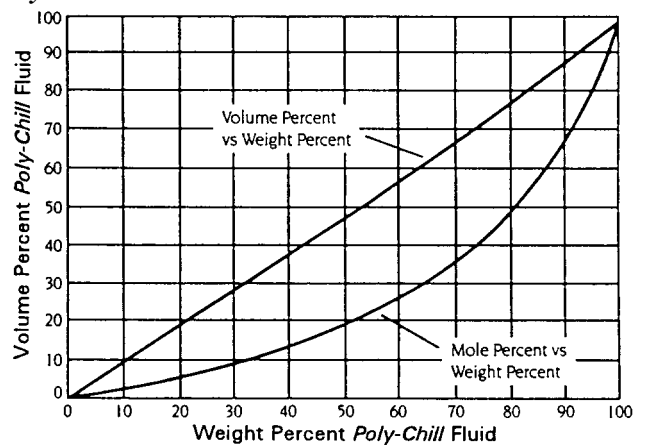
**Figure 4**  
Refractometer-Determined Freezing Points



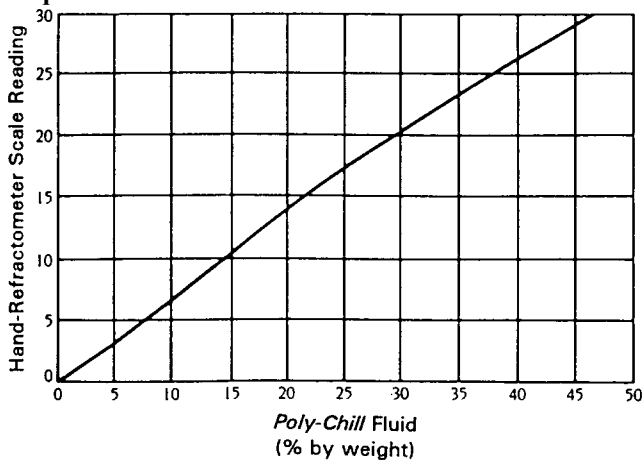
**Figure 2**  
Refractive Index of Aqueous Solutions



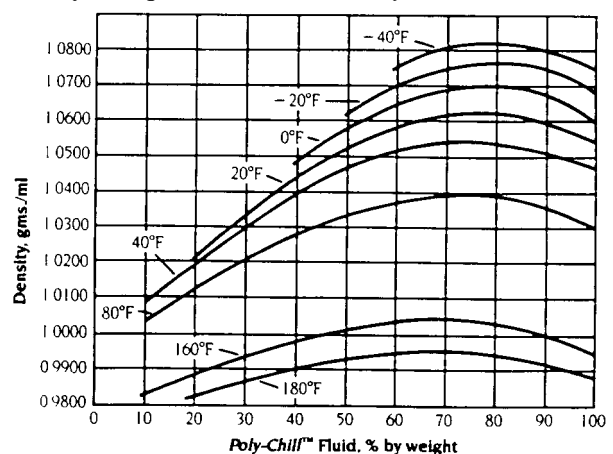
**Figure 5**  
Conversion Chart for Aqueous Solutions of Poly-Chill Fluid



**Figure 3**  
Refractometer-Determined Concentration of Aqueous Solutions

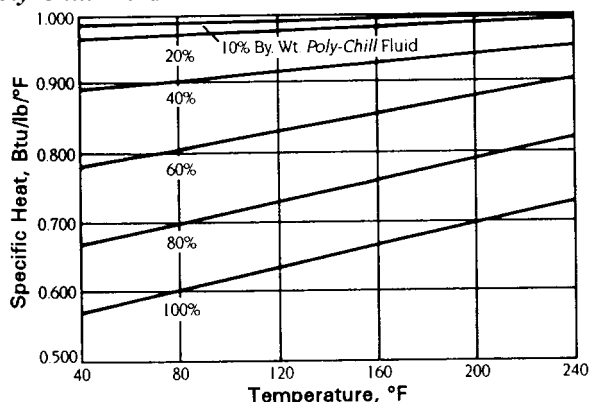


**Figure 6**  
Density of Aqueous Solution of Poly-Chill Fluid

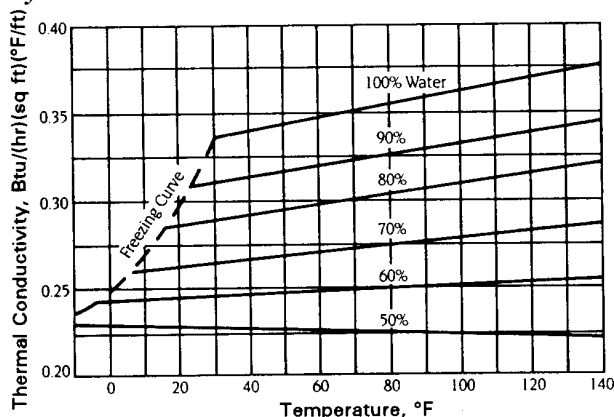




**Figure 7**  
Specific Heat of Aqueous Solution of  
*Poly-Chill* Fluid



**Figure 8**  
Thermal Conductivity of Aqueous Solutions of  
*Poly-Chill* Fluid



Note 4: If the normality of the HCl is not exactly 0.100N, an adjustment needs to be made as follows:

$$RA = (A * N) / 0.1$$

RA is mL 0.100N HCl per 10 mL sample.

N is normality of HCl actually used.

A is mL of HCl of normality N needed.

Note 5: If the result needs to be expressed as weight percent  $K_2HPO_4$ , the following calculation should be used:

$$\%K_2HPO_4 = (A * N * 17.48) / w$$

A is mL HCl used

N is Normality of HCl used

w is weight of fluid sample used

It is not necessary to convert to 0.100N HCl for the weight percent calculation.

### Tank Regeneration

It is recommended that the weight percent of  $K_2HPO_4$  remain above 0.5%. The normal amount depends on the dilution used, i.e. in a 50% mix, the normal level is 1.0%, in a 33% mix it is 0.7%. To raise the additive level by 0.1%, 0.9 lbs of  $K_2HPO_4$  per 100 gallons of fluid must be added. The salt must be added as an aqueous solution or as a solution in a portion of the actual fluid. If water is used, it should be kept to a minimum.

EXAMPLES: Typical tank dilutions are 50% and 33%. At these dilutions, the relationship between mL 0.100N HCl and  $\%K_2HPO_4$  is:

DILUTION	mL 0.100N	$\%K_2HPO_4$
50%	5.7	1.0%
50%	2.9	0.5%w
33%	4.0	0.7%
33%	2.9	0.5%

Note that in all cases, a value less than 0.5% or 2.9 mL indicates a depletion of additive, and the tank regeneration procedure should be followed.

### Storage and Handling

Propylene glycol is non-corrosive and non-toxic, it has a low vapor pressure and high flash point. It is easily handled under ordinary commercial conditions. Storage in mild steel is satisfactory, except where color requirements are critical. Protection from discoloration can be obtained by storage in resin-lined steel, glass, aluminum or stainless steel containers.

### For More Information

#### Technical Service

Technical service is available to facilitate further use of *Poly-Chill* fluid. If you have a specific question or need further information, please write or call Organics Technical Service, Arch Chemicals Inc., P.O. Box 547, 2450 Highway 933, Brandenburg, KY 40108-0547; (502) 422-6924 or fax: (502) 422-6909.

#### Shipping Information

Containers: tank cars compartmented tank cars, tank trucks and 55-gallon (450 lbs net) resin-lined drums.



**Technical  
Product  
Information**

# GLYCOLS

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To place orders for delivery in the U.S. or Canada and to get fast answers on order status or product availabilities, call our toll-free number: (800) 636-3786. (From Kentucky, call (502) 422-6457, collect.)

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